REMARKS/ARGUMENTS

The Office Action dated May 31, 2005, has been carefully reviewed and the following remarks are made in consequence thereof.

Claims 1-4 remain active in this application.

The Examiner rejected claims 1-4 under 35 U.S.C. 103(a) as being unpatentable over Samuelson et al. in view of Akkara et al. (Hematin catalyzed polymerization of phenol compounds).

Samuelson et al. teach the polymerization of aromatic compounds in the presence of different templates using the enzyme horseradish peroxidase (HRP). The pH described (Column 3 line 57) for the reaction is in the range of pH 4 -10. HRP is not active/stable between pH 0.5 and 4. Consequently HRP cannot be used at very low pH to polymerize any monomers. The system comprising an assembled hematin compound, described in Applicants' claims 1-4 is active at such low pH, thus increasing the range of pH for the aromatic polymerization which is clearly distinct from Samuelson et al..

Akkara et al. describe the polymerization of aromatic compounds catalyzed by hematin. The pH for the reactions is in the range of pH 3.5 -7.5. Hematin is not soluble in low pH conditions and consequently not active between pH 0.5 and 4. Applicants' system comprising an assembled hematin, as described in claims 1-4, is active at low pH, thus increasing the range of pH for the aromatic polymerization.

Assembling of hematin is a crucial step for the use of the catalyst at extreme low pH. Applicants' teachings open new avenues for the polymerization of aromatic compounds.

The Examiner states that the Samuelson reference discloses a method of polymerizing an aromatic monomer using a template and an enzyme such as horseradish peroxidase but it does not determine what it is. Akkara determines that horseradish peroxidase derived from hematin derivatives. The determination of said horseradish to be hematin derivative to be associated with the template such as polyelectrolyte, cationic polymer would not provide an unexpected result to one of ordinary skill in the art.

Claims 1-4 of the present application refer to hematin electrostatically assembled on a substrate in one or more layers of a polyelectrolyte. The role of the polyelectrolyte described in claims 1-4 is completely different from purpose for which polyelectrolytes are used in the case of Samuelson et al. In the present invention claims 1-4, the polyelectrolyte (a cationic polymer) is used to immobilize a catalyst i.e hematin (by sequential layer-by-layer assembly) while in the case of Samuelson et al., polyelectrolytes are used as "templates" for the oxidative polymerization reaction. Samuelson et al. involves horseradish catalyzed polymerization of aromatic monomers in the presence of the polyelectrolytes, wherein the conducting polymer formed remains complexed with the polyelectrolyte. On the other hand the present invention refers to the development of a catalyst based on hematin that has been electrostatically layered using polyelectrolytes. The role of the cationic polyelectrolyte in this case is to facilitate the immobilization of hematin. This catalyst can also be used for the polymerization of aromatic monomers.

In addition, Samuelson et al.teach the polymerization of aromatic compounds in the presence of different templates using the enzyme horseradish peroxidase (HRP). The pH described (Column 3 line 57) for the reaction is in the range of pH 4 -10. HRP is not

active/stable between pH 0.5 and 4. Consequently HRP cannot be used at very low pH to polymerize any monomers. The system comprising an assembled hematin compound, described in claims 1-4 of Applicants' application is active at such low pH, thus increasing the range of pH for the aromatic polymerization which is clearly distinct from Samuelson et al.

The Examiner states that the Akkara reference does disclose the horseradish peroxidase, an enzyme utilizes a heme-iron factor to interact with the peroxide, yielding an oxidized heme-iron complex I and a further heme-iron complex II to polymerize phenols and aromatic analines.... It would have been obvious to one of ordinary skill in the art to employ the heme-iron complex, as disclosed in Akkara, as horseradish peroxidase, to associate with the template, as disclosed in Samuelson, in order to gain the advantages of the combination of the references, that being the products, undergo oxidative dehydrogenation reactions catalyzed by an enzyme, thereby enabling the modification of polyphenol properties.

Samuelson et al. describes a method of using polyelectrolytes to biocatalytically synthesize (using peroxidase) molecular complexes of polymers and polyelectrolytes. The purpose of using the polyelectrolyte is only to solubilize the final polymeric complex. The catalyst described is unmodified horseradish peroxidase. Akkara et al. describes the polymerization of aromatic compounds catalyzed by hematin, and the pH for the reactions is in the range of pH 3.5 -7.5. Hematin is not soluble in low pH conditions and consequently not active between pH 0.5 and 4. The modified hematin (hematin assembled using polyelectrolytes) in the present invention is active at low pH, thus increasing the range of pH and monomers suitable for the aromatic polymerization.

The Examiner states that the determination of said horseradish to be hematin derivative to be associated with the template such as polyelectrolyte, cationic polymer would not provide an unexpected result to one of ordinary skill in art.

Applicants assert that the assembling of hematin is a crucial step for the use of the catalyst at extreme low pH. This discovery opens new avenues for the polymerization of a wider variety of aromatic compounds under lower pH conditions. The association of hematin with polyelectrolytes has produced unique results wherein this novel electrostatically assembled hematin catalyst can be used in pH conditions where neither hematin (Akkara et al.) nor horseradish peroxidase (Sameulson et al.) exhibit significant catalytic activity. The fundamental basis for the use of polyelectrolye for the creation of this layered hematin is to dramatically improve the catalytic utility of hematin over a wide range of pH conditions.

In view of the foregoing remarks, it is believed that Claims 1-4 in this application are allowable and Notice to that effect is respectfully solicited.

Should the Examiner wish to contact Applicants' attorney regarding this application, the Examiner is respectfully invited to do so by calling or writing the undersigned in the Office of Counsel, U.S. Army Soldier Systems Center, Natick, MA 01760 at (508) 233-4510.

Respectfully submitted,

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Date

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